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⑤④ Stethoscope with removable insert.

⑤⑦ A stethoscope including a bell and a removable insert therefore to better accomodate dimunitive skin areas. The insert is made of a resilient and deformable material. The insert snaps into the bell to releasably lock the insert into the bell. The insert reduces the opening to and the volume of the bell.

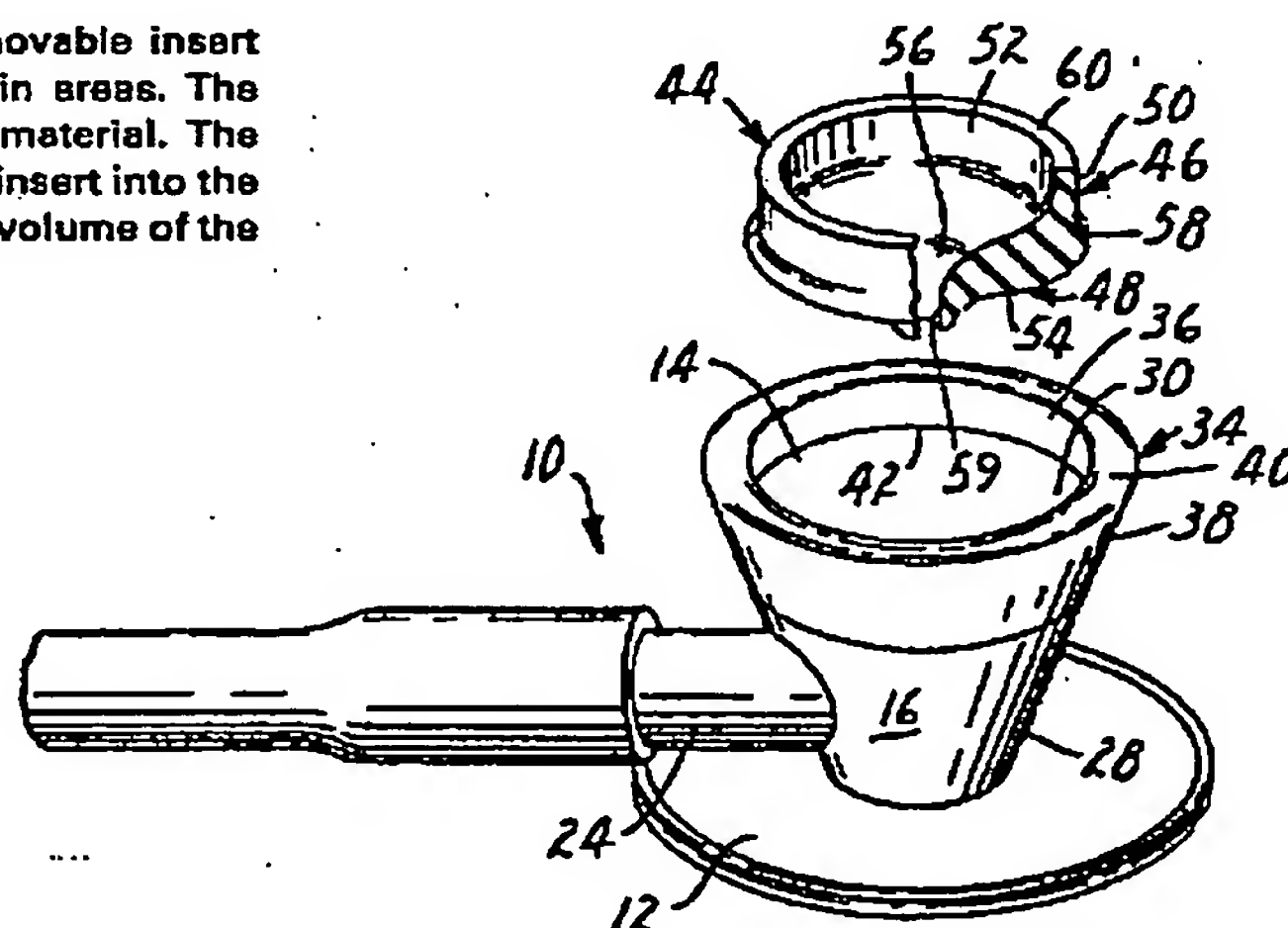


FIG. 1

STETHOSCOPE WITH REMOVABLE INSERT

BACKGROUND OF THE INVENTION

5 The present invention relates to stethoscopes.
More particularly, it relates to stethoscopes in which the
bell may be reduced in diameter to better accomodate
diminutive skin areas.

10 The chest piece of most medical stethoscopes are
of the so-called dual-head type having opposed diaphragm
and open bell sides which are adapted for detecting high
frequency and low frequency sounds, respectively. Dual-
head stethoscopes of this type are described, for example,
in U. S. Patent Nos. 3,108,652; 3,152,659; 3,215,224;
3,224,526; 3,276,536; 3,303,903; 3,366,198; and 3,515,239.

15 Problems are frequently encountered when the bell
side of conventional stethoscope chest pieces are used on
pediatric patients or on skin areas of high curvature. In
such cases, it is many times difficult to acoustically seal
the rim of the open bell with the underlying skin.

20 U. S. Patent No. 3,223,195 discloses a
stethoscope head construction comprising a double ended
receiver having a large bell at one end, a small bell at
its distal end and a core which is shiftable to
successfully implement the operative condition of either of
25 these bells. The large bell is said to be intended for low
frequency range reception of sound, and the small bell is
intended for high amplitude low frequency sound reception.
The small bell also is described as suitable for use on
"bony" type chests and in pediatrics and for listening to
30 small localized areas of a chest. The stethoscope head
construction is relatively complicated and not believed to
conveniently adapt a conventional stethoscope chest piece
for use on pediatric patients and areas of high curvature.

SUMMARY OF THE INVENTION

According to the invention, there is provided a simple stethoscope head construction accomodating a removable, resilient insert for greater flexibility and ease of useage. The stethoscope head comprises a body having a bore therein, a bell side connected to the body and having a central aperture therein opening into the bore in the body, a continuous peripheral rim connected to the bell and a resilient, deformable, generally bell-shaped insert capable of being placed within the volume of the bell such that an aperture in the insert is axially aligned with the aperture in the bell. The insert is releasably locked within the volume of the bell to facilitate its use when called for in the medical practitioner's judgment.

The removable insert is used in a conventional bell to substantially reduce the diameter of the bell and to facilitate the use of the stethoscope on diminutive chests and other body areas. By reducing the diameter of the bell, sound leakage from under the edge of the bell may be effectively eliminated on small areas or areas of high curvature. At the same time, the sound reception of the bell at the frequencies used in diagnostic auscultation may be improved by reducing the volume of the bell. The stethoscope head is simple and may be used in a wide range of diagnostic environments. It may be used on adults and quickly and easily converted for use on a child or newborn infant. A further advantage of the stethoscope of the invention is that it utilizes a removable insert of a non-metallic material to avoid the uncomfortable chill accompanying the use of a conventional steel or other metal stethoscope. The insert may be quickly and easily removed for cleaning.

Other objects and advantages of the invention will become more apparent from the following drawings

wherein like numerals refer to like parts, the accompanying description and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Figure 1 is an elevated and exploded perspective view of a stethoscope head with a removable insert with portions broken away.

 Figure 2 is a transverse, cross-sectional view of the stethoscope head of Figure 1.

10 Figure 3 is a transverse, cross-sectional view of the removable insert shown in Figures 1 and 2.

 Figure 4 is a top view of the removable insert shown in Figure 1.

15 Figure 5 is a transverse, cross-sectional view of the stethoscope head of Figure 1 and a first alternative removable insert with portions broken away.

 Figure 6 is a transverse, cross-sectional view of the stethoscope head of Figure 1 and a second alternative removable insert with portions broken away.

20 Figure 7 is a transverse, cross-sectional view of the stethoscope head of Figure 1 with a third alternative removable insert with portions broken away.

DESCRIPTION OF THE PREFERRED EMBODIMENT

25 Referring to Figures 1 - 4, wherein like reference characters designate like parts throughout the several views, a stethoscope head 10 is shown with a conventional diaphragm 12 in back-to-back relation with an open bell 14 separated by an intermediate body portion 16.
30 At the apex of diaphragm 12 and bell 14 are aligned apertures 18 and 20, respectfully, leading to a bore 22 through body 16. Apertures 18 and 20 are aligned substantially perpendicular to bore 22.

35 Body 16 is fitted with a conventional tubular stem 24. Stem 24 is, in turn, conventionally adapted to rotate within and relative to body portion 16 and has conventional aligning means to align at least the opening

(not shown) in stem 24 with either aperture 18 or 20 to provide a sound passageway from the selected and properly aligned bell 14 or diaphragm 12 to stem 24. Stem 24 is adapted to be connected to a conventional binaural head set (not shown). The specific stethoscope head construction may vary greatly in accordance with known practice and may in some cases comprise a single bell rather than a dual-head construction such as that illustrated.

The bell 14 has a continuous peripheral rim 26. Rim 26 lies in a plane spaced outwardly from and at all places equidistant from the central aperture 20. This rim is continuous with an outer annular wall 28 and an inner annular wall 30. Outer annular wall 28 includes a notch 32. The inner wall 30 of bell 14 is bell shaped with its outer extremities approaching a parallel with outer wall 28. The extreme outer edge of bell 14 is narrow in diameter and tapered from a wider base to a curved edge as illustrated.

An annular cover 34 covers the rim 26 of bell 14. Cover 34 is preferably formed of an annular, flexible, resilient material. It may be formed of a neoprene or other synthetic rubber material which may be stretched or distorted to be snapped over the rim 26. The cover 34 is formed with opposed and spaced apart annular side walls 36 and 38. Outer side wall 38 is slightly longer than inner side wall 36 and terminates at notch 32. Annular side walls 36 and 38 are interconnected by an annular web 40 and are relatively thick to provide the cushioning cover 34 over rim 26. Web 40 is integral with side walls 36 and 38 and forms the top of cover 34. Side walls 36 and 38 engage the inner side wall 30 and the outer sidewall 28 respectively of bell 14 adjacent rim 26 to hold cover 34 in place. Side wall 36 terminates at lip 42.

Cover 34 provides a resilient continuous edge adapted to be deformed to conform with the body of the patient against whom it is pressed. The deformation is a continuous and gentle one so that the overall shape of the

bell 14 is not significantly changed while at the same time leakage from under the edge of the bell 14 is effectively eliminated.

Adapted for insertion into bell 14 is resilient and compliant insert 44. Insert 44 is comprised of a substantially cylindrical portion 46 and a substantially bell shaped portion 48. Cylindrical portion 46 has an outer wall 50 and an inner wall 52. Similarly bell shaped portion 48 has an outer wall 54 and an inner wall 56.

Outer wall 50 curves outwardly at its juncture with outer wall 54 to form a ridge 58. Outer walls 50 and 54 conform to and substantially follow the curvature and shape of the inner surface of bell 14. This is best seen in Figure 2. Ridge 58 fits snugly into lip 42 formed by the juncture of the edge of covering 34 at inner side wall 36 with inner annular wall 30 of bell 14.

Cylindrical portion 46 extends above peripheral rim 26 to contact the skin of the patient and to allow for easy insertion and removal of insert 44 from bell 14. More particularly, because of the resilient composition of insert 44, it may be conveniently snapped in and out by merely grasping cylindrical portion 46 by hand. This allows for easy useage and simultaneously eliminates the need for an additional bell or mechanical alteration of the existing bell.

The inner contour of insert 44, as defined by inner walls 52 and 56, substantially forms a bell shape. Inner wall 56 terminates at central aperture 59 to allow soundwaves picked up on a patient's chest or other body parts to be communicated to aperture 20. Ridge 58 follows the inner contour of bell 14 and nestles tightly against covering 34 at lip 42 to hold insert 44 in place within the bell microphone 14. The region between outer wall 50 and ridge 58 is curved to follow the contour of the exposed surface of inner side wall 36 of covering 34. Similarly, the region between outer wall 54 and ridge 58 is convex in shape to follow the concave shape dictated by the inner

5 wall of bell 14. The lower regions of bell shaped portion 48, as it approaches aperture 20, are tapered or feathered to merge into aperture 20. Hence, the diameter of aperture 20 as best shown in Figure 2 is not significantly affected by the insertion of insert 44 into bell 14.

10 Stethoscope head 10 is used by contacting head 10 with the patient's skin in a manner well-known in the art. This is the same whether or not insert 44 is used. When the doctor or other user encounters a chest or other body part of sufficiently high curvature or diminutive area, insert 44 is employed. By snapping insert 44 into bell 14, the diameter of peripheral rim 26 is effectively and significantly reduced. Instead of rim 26 contacting the skin, the rim 60 of cylindrical portion 46 contacts the skin. Hence, a smaller portion of relatively flat skin area is required, reducing the likelihood that sound is either lost or interference is picked up around the periphery of the rim 60 of cylindrical portion 46. In other words, the likelihood of extraneous sounds leaking in or the sound to be monitored leaking out is significantly reduced. This has been accomplished without the need of complicated mechanical devices as used in the prior art. At the same time, the objects and advantages of the invention have been accomplished without the need for modification of the basic stethoscope device.

25 From the foregoing, it will be apparent that all of the objectives of this invention have been achieved by the stethoscope head and insert shown and described. It will also be apparent that various modifications and changes may be made by those skilled in the art without departing from the spirit of the invention as expressed in the accompanying claims. For example, insert 44 and cover 34 may be made into a single-piece construction as shown in Figure 5. By combining insert 44 and cover 34 into an integral insert 44a, the shape of the underlying bell 14 may be simplified. The desired size and shape of the internal surface 30 of the bell 14 may be determined by the

size and shape of the integral insert 44a. In this way, one bell may be adapted for a multiplicity of diagnostic uses through the use of a series of inserts. A relatively thinner insert may be used where a greater volume within the bell is desired. A comparatively thicker insert may be used where a smaller volume with a smaller diameter opening to the bell is desired.

It is generally preferable to decrease the volume of the bell whenever the diameter of the opening to the bell is decreased. Reducing the diameter of the bell opening reduces the total sound energy entering the bell, making it increasingly difficult for the physician or other user to detect the sound desired to be monitored. It is well known that reducing the volume of the bell increases the efficiency with which sound energy is transmitted to the sound-receiving aperture. Hence, whenever the diameter of the opening of the bell is decreased, it is generally preferable to reduce the volume of the bell simultaneously.

Rather than thickening the overall insert to reduce the volume within the bell, the portion of the insert that locks the insert within the bell needs only be thickened as shown in Figure 6. As a result, rim 60-b may be kept relatively narrow to greater insure a complete seal around the periphery of insert 44-b when applied to the skin of a patient.

Rim 60-b of insert 44 may be narrowed significantly by forming the outside wall 50-b of cylindrical portion 46-b closer to the inside wall 52-b. By moving the outside wall 50-b in, material is saved, a generally preferred narrow rim 60-b is retained and the performance of the stethoscope head 10 is unaffected. The limit to which outside wall 50-b may be drawn in is the point at which ridge 58-b no longer fits snugly into lip 42. All of the outside wall 50-b of portion 46-b above lip 42 may be moved radially in and not contact side wall 36, assuming the material from which insert 44-b is formed is sufficiently firm to hold portion 46-b in the upright

position even when not supported by side wall 36.

5 In the case of an insufficiently firm insert, the entire insert may be thickened as shown in Figure 7 to afford it greater rigidity throughout. Referring to Figure 7, an insert 44-c is shown with a comparatively thicker rim 60-c. Thicker rim 60-c results from outside wall 50-c of cylindrical portion 46-c overlapping inner side wall 36 of covering 34.

10 Because all of these modifications and changes may be made by one skilled in the art and without departing from the spirit of the invention as expressed in the accompanying claims, all matter shown and described is to be interpreted as illustrative and not in a limiting sense.

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CLAIMS:

1. A stethoscope head 10 comprising:

- a. a body 16 having a bore 22 therein;
- b. a bell 14 connected to the body 16 and having a central aperture 20 therein opening into the bore 22 and comprising (1) an inner, generally bell-shaped side wall 30, (2) an outer side wall 28 and (3) a continuous peripheral rim 26 formed on the bell 14 equidistant from the bell aperture 20 at all places and connecting the inner side 30 wall to the outer side wall 28;
- c. a resilient, deformable cover 34 over the rim 26 reducing the inside diameter of the rim 26; and
- d. a one-piece, removable, resilient, deformable insert 44 of substantially bell-shaped configuration juxtaposed the inner side wall 30 of the bell 14 and having a central aperture 59 therein axially aligned with the aperture 20 in the bell 14 and including an annular ridge 58 which engages the resilient cover 34 to releasably lock the insert 44 within the bell 14 and adjacent the inner side wall 30 of the bell 14.

2. The stethoscope 10 recited in claim 1 wherein the insert 44 further comprises:

- a. a cylindrical portion 46 including a first end extending beyond the resilient cover 34 and a second end connected to the annular ridge 58; and

- b. a bell-shaped portion 48 including a first end connected to the annular ridge 58 and a second end terminating at the aperture 59 of the insert 44.

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3. The stethoscope 10 recited in claim 2 wherein the second end of the bell-shaped portion is tapered towards the aperture 59 whereby a smooth transition is provided between the aperture 59 of the insert 44 and the aperture 20 of the bell 14.

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4. The stethoscope 10 recited in claim 3 wherein the diameter of the aperture 59 in the insert 44 is substantially equal to the diameter of the aperture 20 in the bell 14.

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5. The stethoscope 10 recited in claim 4 wherein the annular ridge 58 on the insert 44 comprises:

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- a. a convex-shaped portion 54 formed from the first end of the bell-shaped portion 48 of the insert 44 and contacting the inner side wall 30 of the bell 14; and

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- b. a concave-shaped portion 50 formed from the second end of the cylindrical portion 46 of the insert 44 and contacting the cover 34 and connected to the convex-shaped portion 54 to form the annular ridge 58.

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6. The stethoscope 10 recited in claim 5 wherein the outside diameter of the cylindrical portion 46 of the insert 44 is substantially equal to the inside diameter of the resilient cover 34.

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7. The stethoscope 10 recited in claim 6 wherein the cylindrical portion 46 of the insert 44 extends sufficiently beyond the resilient cover 34 to contact the skin area to be monitored and to facilitate removal of the insert 44 by hand.

8. A one-piece, deformable and resilient stethoscope head insert 44 comprising:

- a. an upper portion 46 including a cylindrically-shaped outer wall 50, a curved inner wall 52 and a rim connecting the outer wall 50 to the inner wall 52;
- b. a lower portion 48 (1) connected to the upper portion 46, (2) including a bell-shaped outer wall 54 and a curved inner wall 56 connected to the inner wall 52 of the upper portion 46 whereby a continuous, bell-shaped interior surface 52 and 56 is formed within the insert 44 and (3) having a central aperture 59 thereat whereat the outer 54 and inner 56 walls of the lower portion 48 are tapered to meet; and
- c. a continuous, circumferential ridge 58 connecting the outer wall 50 of the upper portion 46 with the outer wall 54 of the lower portion 48.

9. The insert 44 recited in claim 8 wherein the ridge 58 comprises:

- a. a concave-shaped portion 50 connecting the cylindrically-shaped outer wall 50 of the upper portion 46 with the ridge 58; and

- b. a convex-shaped portion 54 connecting the bell-shaped outer wall 54 of the lower portion 48 with the ridge 58.

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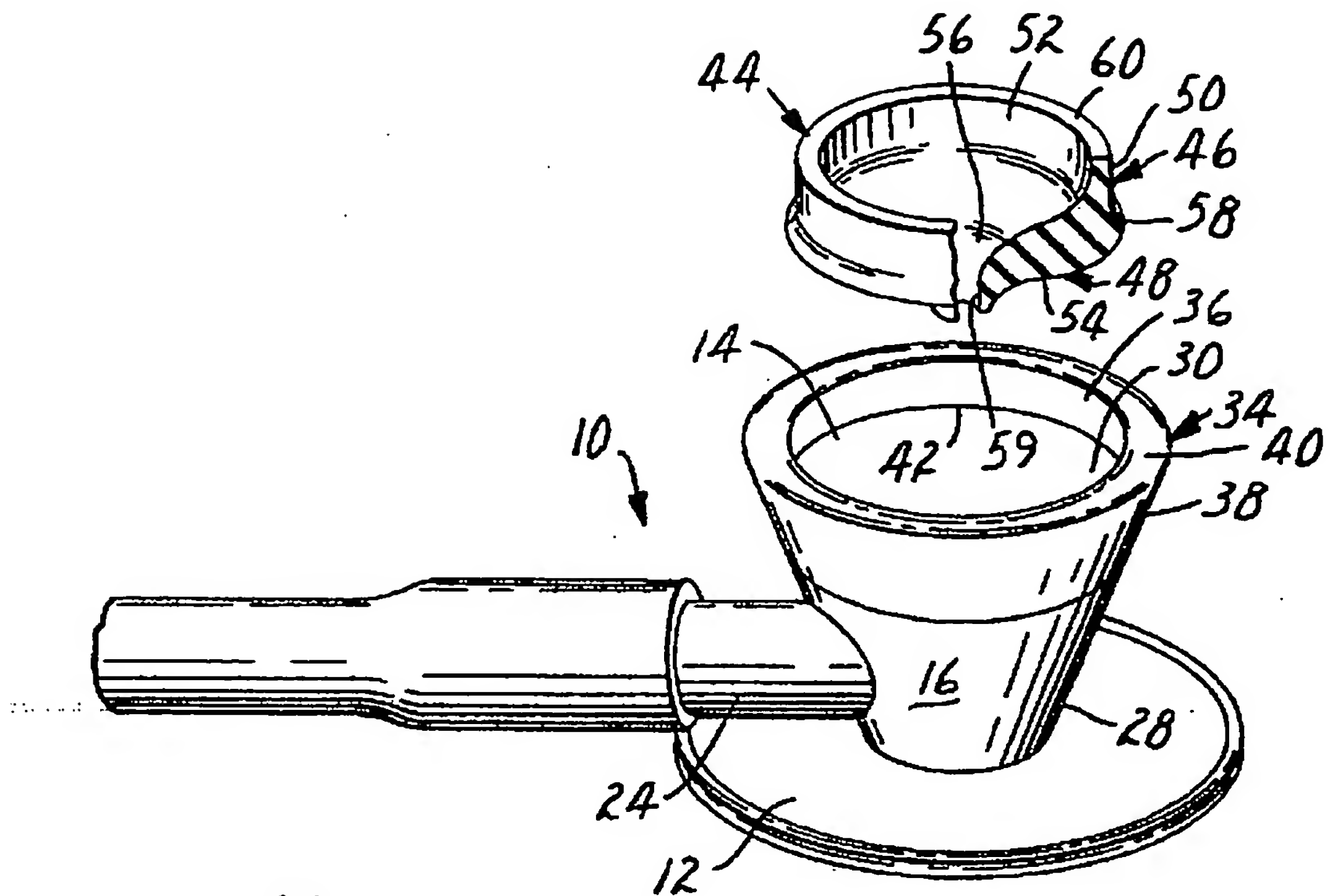


FIG. 1

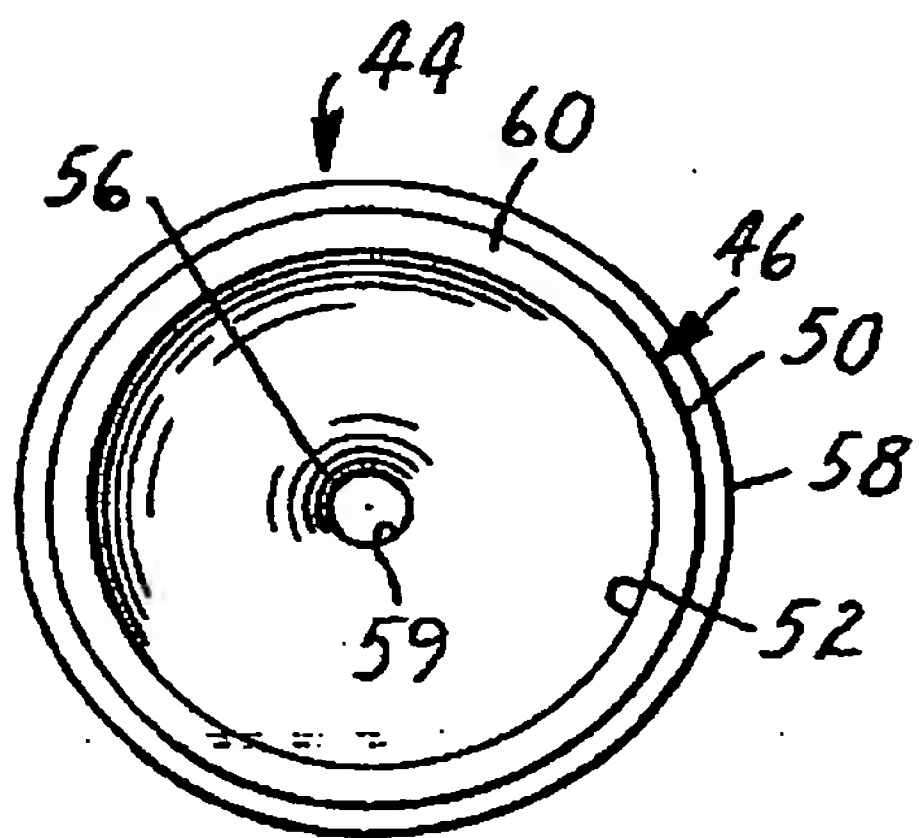


FIG. 4

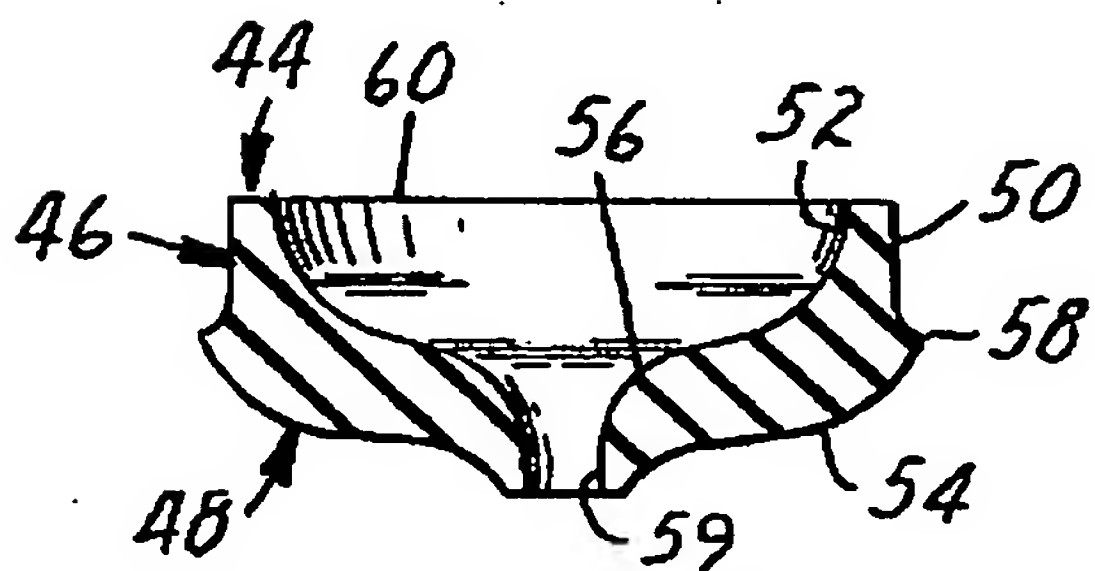


FIG. 3

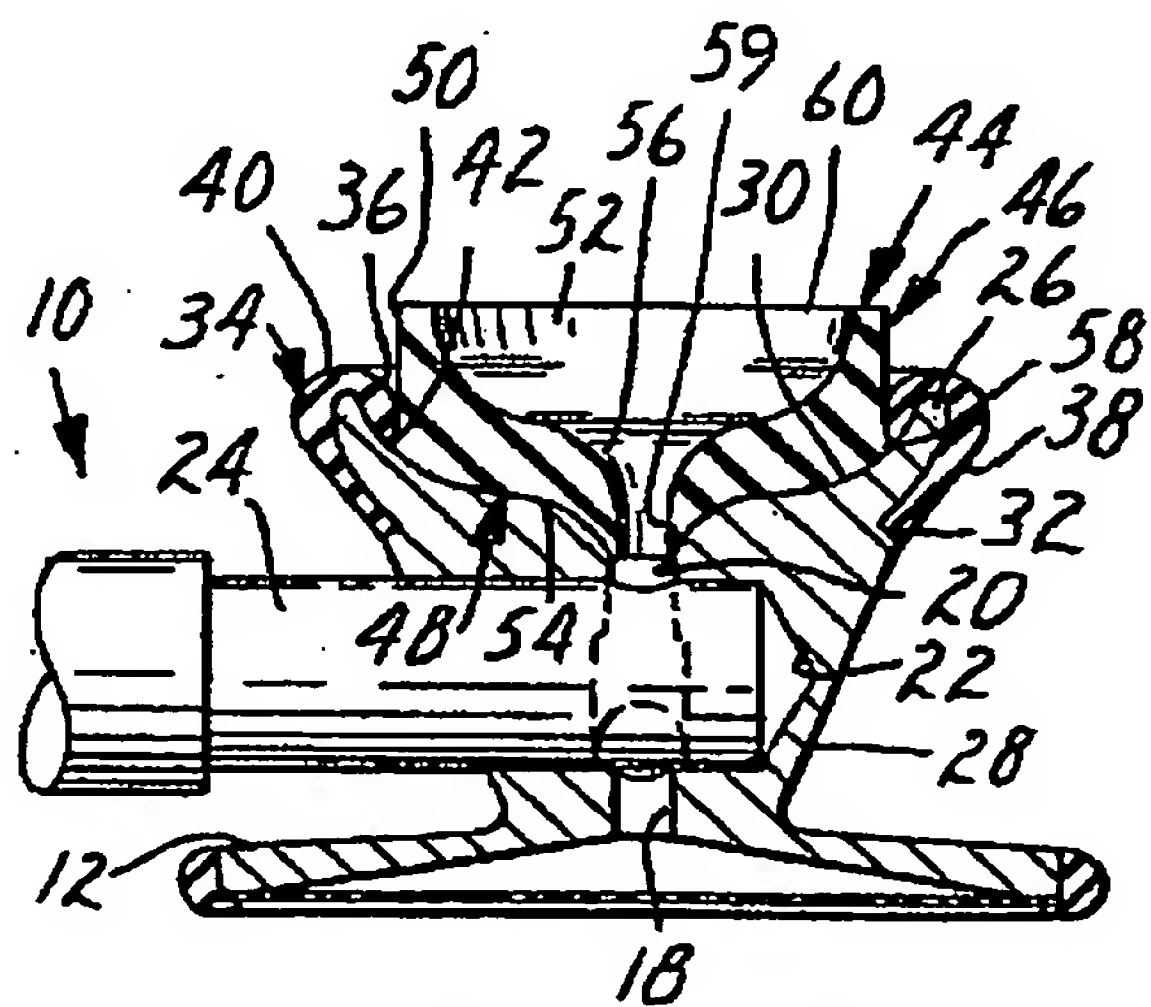
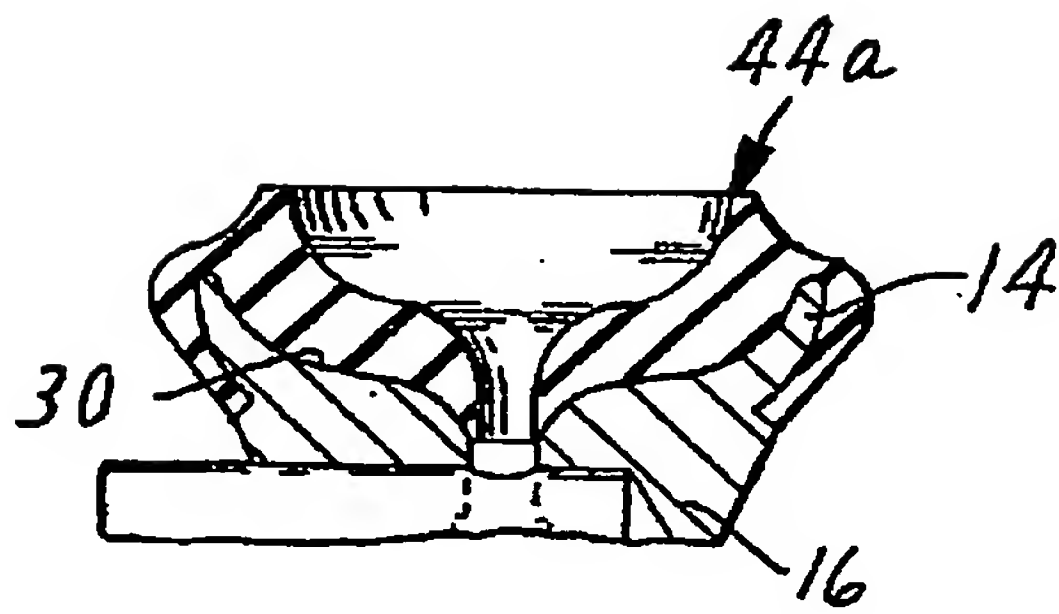
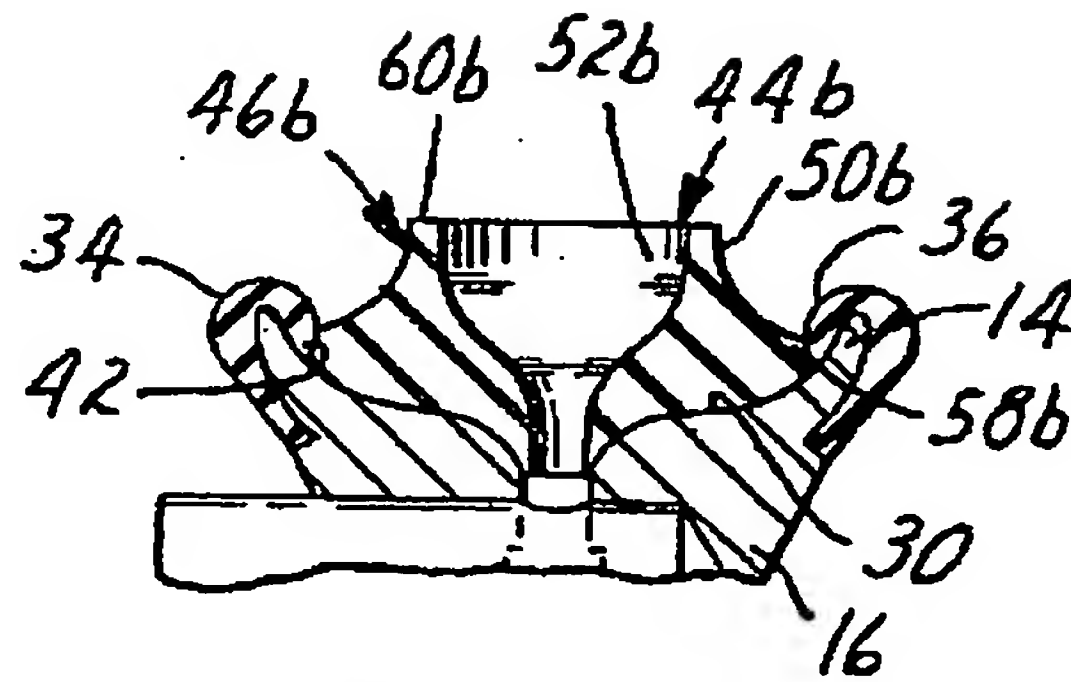
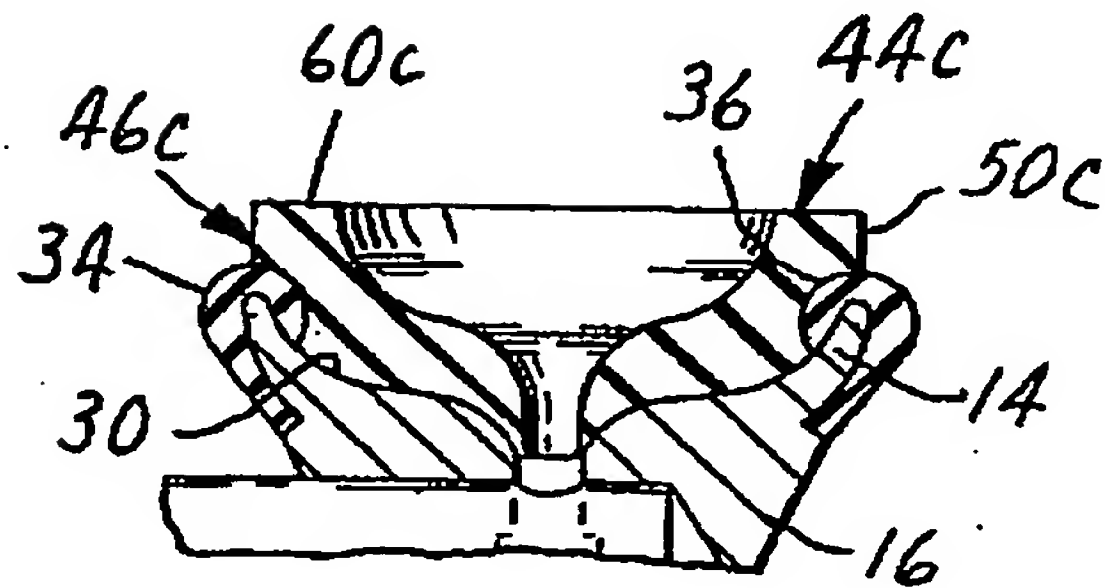


FIG. 2

**FIG. 5****FIG. 6****FIG. 7**